

REMARKS

Claims 24, 27, 32-33 and 40-48 are pending in this application. By this Amendment, claim 24 is amended to incorporate the subject matter of claims 25 and 31 and to further define the subject matter recited therein. The amendments to claim 24 are supported at least by page 7, lines 19-23, page 8, lines 21-22, page 9, lines 1-4 and page 10, lines 12-16 of the original specification. Claims 32-33 and 42 are amended for antecedence. Claims 47 and 48 are added and are supported at least by page 9, lines 1-4 of the specification. Claims 25, 26, 31 and 35-39 are canceled. No new matter is added by this Amendment.

I. Interview

The courtesies extended to Applicants' representative by Examiner Cullen and Examiner Hodges at the interview held March 31, 2010, are appreciated. The reasons presented at the interview as warranting favorable action are incorporated into the remarks below, which constitute Applicants' record of the interview.

II. Rejections Under 35 U.S.C. §103(a)

A. Claims 24-27, 31-33 And 35-39

The Office Action rejects claims 24-27, 31-33 and 35-39 as allegedly being unpatentable over U.S. Patent No. 5,597,660 ("Bates") in view of U.S. Patent Application Publication No. 2003/0027049 ("Barker"). Applicants respectfully traverse this rejection.

Claims 25, 26, 31 and 35-39 are canceled, rendering the above rejection moot with respect to these claims. The rejection is further traversed to the extent that it may be applied to amended claim 24, which includes the subject matter of claims 25 and 31.

1. Claim 24

As discussed above, Applicants have amended claim 24 to recite Microbattery comprising: a first electrode formed as a thin layer, the first electrode consisting of a first active compound $A_{x1}T_{y1}[PO_4]_{z1}B_{w1}$, in which a chemical element E selected from the group

consisting of metals and carbon is dispersed in the first active compound, a second electrode formed as a thin layer, the second electrode consisting of a second active compound $A_{x_2}T'_{y_2}[PO_4]_{z_2}B'_{w_2}$, in which a chemical element E' selected from the group consisting of metals and carbon is dispersed in the second active compound, and, wherein A in the first active compound and the second active compound is a same or different alkaline metal ion selected from the group consisting of lithium and sodium, wherein T in the first active compound and T' in the second active compound are each a same or different mixture of metallic ions comprising at least one transition metal ion selected from the group consisting of titanium, vanadium, chromium, cobalt, nickel, manganese, iron, copper, niobium, molybdenum and tungsten, wherein B in the first active compound and B' in the second active compound are each a same or different chemical element selected from the group consisting of sulphur, oxygen, fluorine and chlorine, wherein x_1 and $w_1 \geq 0$ and y_1 and $z_1 > 0$, and x_2 and $w_2 \geq 0$ and y_2 and $z_2 > 0$, a solid electrolyte disposed between the first electrode and the second electrode, the solid electrolyte being formed as a thin layer consisting of a compound comprising at least a [PO₄] grouping, wherein the first electrode and the second electrode have different intercalation potentials of the alkaline metal ion A.

In other words, the microbattery recited in claim 1 is a thin-film battery. As background, thin-film battery technology is also referred to as all-solid state thin-film technology. For the convenience of the Patent Office, below is a schematic of a thin-film battery.

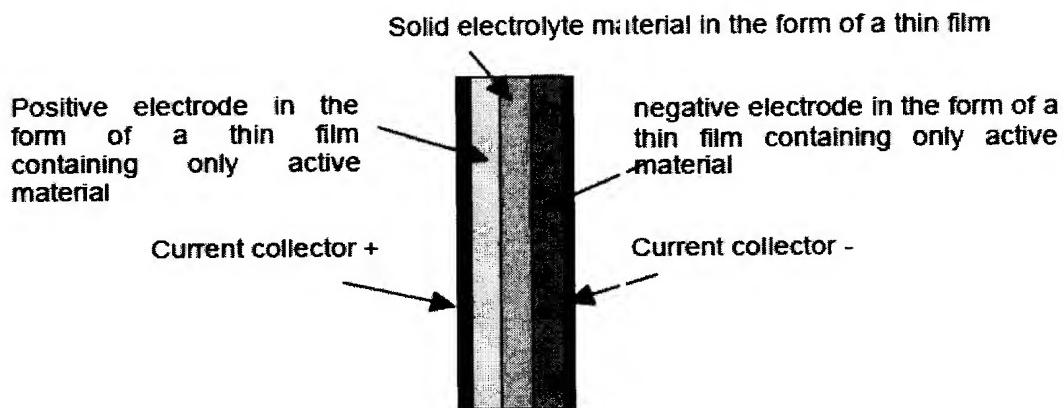


Figure 1: Schematic Of A Thin-Film Battery

As shown above in Figure 1, the electrodes and the electrolyte of the thin-film battery are solid thin-layers (i.e., a micrometric thickness) consisting of active materials, wherein the electrodes and the electrolyte are generally obtained by a thin layer vacuum deposition technique.

Because the components of the thin-film battery are comprised of solid materials, during operation, electrochemical reactions are only obtained at the interfaces between the electrodes and the electrolyte since the active materials present in the electrodes and electrolyte only contact each other at the interfaces. For this reason, a common problem in thin-film batteries is a high amount of electrical resistance at the interfaces between the electrodes and the electrolyte.

However, the microbattery recited in claim 2¹ comprises electrode active materials and electrolyte active materials that each contains a [PO₄] common grouping. This common grouping allows the microbattery to obtain a reduced amount of electrical resistance because the common [PO₄] grouping enables a certain continuum or homogeneity to exist in the thin-film layers of the microbattery. See page 6, lines 14-21 of the present specification.

2. Bates And Barker

Applicants submit that one having ordinary skill in the art would not have been provided with any reason or rationale to have modified the thin-film battery described in Bates with the active material described in Barker to have arrived at the thin-film battery recited in claim 24, with any reasonable expectation of success.

Bates discloses an electrolyte (26) for a thin-film battery, wherein the electrolyte has the composition $\text{Li}_x\text{PO}_y\text{N}_z$. Bates, Abstract and column 3, lines 59-60. The electrolyte is arranged between two electrodes (24) and (28) formed of vanadium-oxide and lithium, respectively. Bates, column 3, lines 42-43 and column 4, lines 14-15. However, as discussed above, Bates does not describe a microbattery comprised of a solid electrolyte, first electrode and second electrode, wherein the electrolyte and the electrodes consist of an electrode active material having a $[\text{PO}_4]$ grouping (i.e., first electrode -- $\text{A}_{x1}\text{T}_{y1}[\text{PO}_4]_{z1}\text{B}_{w1}$; second electrode -- $\text{A}_{x2}\text{T}_{y2}[\text{PO}_4]_{z2}\text{B}_{w2}$ and electrolyte -- $[\text{PO}_4]$ grouping)

Barker describes a completely different type of battery than the thin-film battery described in Bates (and claim 24). Barker describes electrodes formed of active materials comprising a compound of the formula $\text{Li}_a\text{M}_b(\text{PO}_4)\text{Z}_1$. Barker, Abstract and paragraph [0045]. Barker further describes a battery having an electrolyte comprising a polymer matrix containing an ionic conductive medium and a separator. Barker, paragraphs [0150] and [0153].

The battery of Barker is often referred to as a "conventional battery," which, because of its distinctive structure, is not typically associated with the high internal electrical resistance problems of thin-film batteries. For the convenience of the Patent Office, a conventional battery is illustrated below in Figure 2.

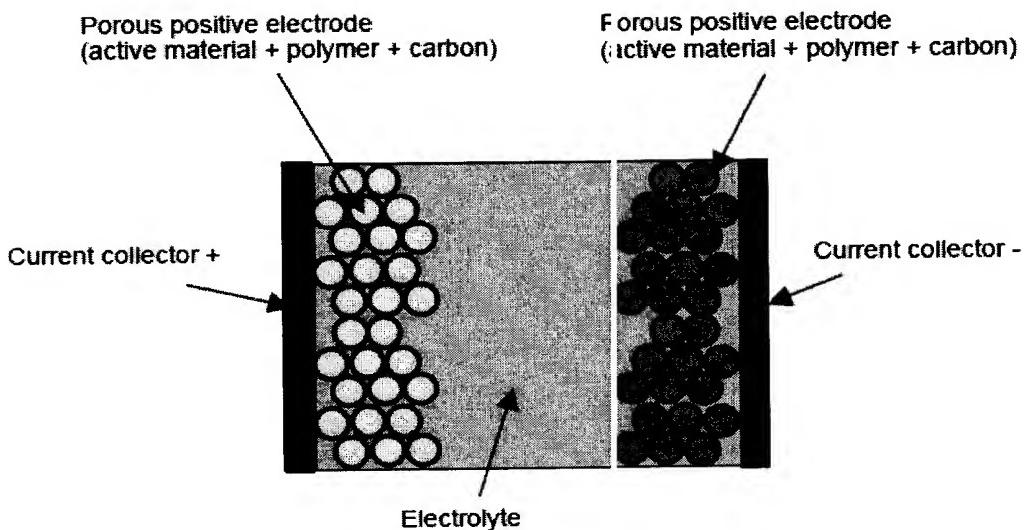


Figure 2: Schematic Of A Conventional Battery

As shown above, in a conventional battery, the electrodes are porous, and the ionic conductive medium can be circulated in the electrode layers. Therefore, the electrochemical reactions in the conventional battery occur throughout the entire conductive medium, and are not limited to occurring at the interfaces between the electrolyte and the electrode layers as in a thin-film battery.

One having ordinary skill in the art would have understood that the disclosure of Barker is related to "conventional battery" technology because the electrodes described in Barker contain not only an electrode active material, but also a binder and an electrically conductive carbonaceous material. Specifically, the electrodes of Barker are formed by mixing the electrode active material into a slurry with a polymeric binder compound, a solvent, a plasticizer and an optional electroconductive material. The slurry is then applied to a substrate and the electrode film is further consolidated. See Barker, paragraphs [0126]-[0133]. Therefore, the electrodes of Barker contain additional materials, and are not in the form of a thin layer consisting of a first active compound $A_{x1}T_{y1}[PO_4]_{z1}B_{w1}$ or a second active compound $A_{x2}T'_{y2}[PO_4]_{z2}B'_{w2}$, as recited in claim 24.

The battery described in Barker is not a thin-film battery, and thus does not result in the problem of high electrical resistance at the interface of the electrodes and electrolyte. For this reason, one having ordinary skill in the art would not have been provided with any reason or rationale to have modified the thin-film battery described in Bates with the active material described in Barker to have arrived at the thin-film battery recited in claim 24, with any reasonable expectation of success.

Accordingly, Bates and Barker, whether taken independently or in concert, fail to render obvious claims 24, 27 and 32-33. Withdrawal of the rejection is therefore respectfully requested.

B. Claims 40 And 41

The Office Action rejects claims 40 and 41 under 35 U.S.C. §103(a) as allegedly being unpatentable over Bates in view of Barker and further in view of U.S. Patent No. 6,287,716 ("Hashimoto"). Applicants respectfully traverse this rejection.

For at least the reasons discussed above, Bates and Barker fail to render obvious independent claim 24. Thus, Bates and Barker also fail to render obvious dependent claims 40 and 41.

Hashimoto does not remedy the deficiencies of Bates and Barker. Hashimoto was introduced as allegedly describing an intermediate layer in an electrode-electrolyte-electrode assembly. See Hashimoto, col. 4, lines 27-40. However, Hashimoto does not describe a microbattery comprising: a first electrode formed as a thin layer, the first electrode consisting of a first active compound $A_{x1}T_{y1}[PO_4]_{z1}B_{w1}$, in which a chemical element E selected from the group consisting of metals and carbon is dispersed in the first active compound, a second electrode formed as a thin layer, the second electrode consisting of a second active compound $A_{x2}T'_{y2}[PO_4]_{z2}B'_{w2}$, in which a chemical element E' selected from the group consisting of metals and carbon is dispersed in the second active compound, and, wherein A in the first

active compound and the second active compound is a same or different alkaline metal ion selected from the group consisting of lithium and sodium, wherein T in the first active compound and T' in the second active compound are each a same or different mixture of metallic ions comprising at least one transition metal ion selected from the group consisting of titanium, vanadium, chromium, cobalt, nickel, manganese, iron, copper, niobium, molybdenum and tungsten, wherein B in the first active compound and B' in the second active compound are each a same or different chemical element selected from the group consisting of sulphur, oxygen, fluorine and chlorine, wherein x_1 and $w_1 \geq 0$ and y_1 and $z_1 > 0$, and x_2 and $w_2 \geq 0$ and y_2 and $z_2 > 0$, a solid electrolyte disposed between the first electrode and the second electrode, the solid electrolyte being formed as a thin layer consisting of a compound comprising at least a $[PO_4]$ grouping, wherein the first electrode and the second electrode have different intercalation potentials of the alkaline metal ion A, as recited in claim 24.

Therefore, Applicants respectfully submit that none of Bates, Barker and Hashimoto, whether taken independently or in concert, render obvious claims 40 and 41. Withdrawal of the rejection is respectfully requested.

C. Claims 42, 45 and 46

The Office Action rejects claims 42, 45 and 46 under 35 U.S.C. §103(a) as allegedly being unpatentable over Bates in view of Barker and in further view of U.S. Patent Application Publication No. 2004/0096745 ("Shibano"). Applicants respectfully traverse this rejection.

For at least the reasons discussed above, Bates and Barker fail to render obvious independent claim 24. Thus, Bates and Barker also fail to render obvious dependent claims 42, 45 and 46.

Shibano describes a lithium ion conductor in an all-solid lithium ion rechargeable battery that may be produced by forming an electrode film, an electrolyte and then a second

electrode, and further discloses that the film formation may be carried out by sputtering, vapor deposition, electron beam deposition, laser abrasion, ion plating, CVD, sol-gel method, screen printing and the like. Shibano, Abstract, and paragraphs [0026], [0027], [0029], [0032] and [0033].

However, Shibano fails to remedy the deficiencies of Bates and Barker discussed above, at least because Shibano fails to describe a microbattery comprising: a first electrode formed as a thin layer, the first electrode consisting of a first active compound $A_{x_1}T_{y_1}[PO_4]_{z_1}B_{w_1}$, in which a chemical element E selected from the group consisting of metals and carbon is dispersed in the first active compound, a second electrode formed as a thin layer, the second electrode consisting of a second active compound $A_{x_2}T'_{y_2}[PO_4]_{z_2}B'_{w_2}$, in which a chemical element E' selected from the group consisting of metals and carbon is dispersed in the second active compound, and, wherein A in the first active compound and the second active compound is a same or different alkaline metal ion selected from the group consisting of lithium and sodium, wherein T in the first active compound and T' in the second active compound are each a same or different mixture of metallic ions comprising at least one transition metal ion selected from the group consisting of titanium, vanadium, chromium, cobalt, nickel, manganese, iron, copper, niobium, molybdenum and tungsten, wherein B in the first active compound and B' in the second active compound are each a same or different chemical element selected from the group consisting of sulphur, oxygen, fluorine and chlorine, wherein x_1 and $w_1 \geq 0$ and y_1 and $z_1 > 0$, and x_2 and $w_2 \geq 0$ and y_2 and $z_2 > 0$, a solid electrolyte disposed between the first electrode and the second electrode, the solid electrolyte being formed as a thin layer consisting of a compound comprising at least a $[PO_4]$ grouping, wherein the first electrode and the second electrode have different intercalation potentials of the alkaline metal ion A, as recited in claim 24.

Therefore, Bates, Barker and Shibano, whether taken independently or in concert, fail to render obvious claims 42, 45 and 46. Withdrawal of the rejection is respectfully requested.

D. Claim 43 And 44

The Office Action rejects claims 43 and 44 under 35 U.S.C. §103(a) as allegedly being unpatentable over Bates in view of Barker, Shibano and U.S. Patent Application Publication No. 2005/0280118 ("Lin"). Applicants respectfully traverse this rejection.

For at least the reasons discussed above, Bates, Barker and Shibano fail to render obvious claim 42. Thus Bates and Barker also fail to render obvious dependent claims 43 and 44, which depend from claim 42.

Lin describes a method of manufacturing a microelectronic device, such as a transistor gate, by forming an opening in a dielectric layer located over a substrate, forming a semi-conductive layer substantially conforming to the opening, and forming a conductive layer substantially conforming to the semi-conductive layer. Lin, Abstract and paragraphs [0001] and [0002]. However, Lin fails to remedy the deficiencies of Bates and Barker discussed above.

Lin fails to describe a method for production of a microbattery, wherein a first intermediate thin layer is deposited on the second electrode by means of the first and second sputtering targets before deposition of the electrolyte, as recited in claim 43, or wherein a second intermediate thin layer is deposited on the electrolyte by means of the second and third sputtering targets before deposition of the first electrode, as recited in claim 44. Lin merely discloses the formation of a single metal-silicide layer having a metal constituent that may not be uniform in concentration throughout. Lin, paragraph [0062].

Further, while Lin describes co-sputtering employing a metal target and a silicon containing target (Lin, paragraph [0062]), Lin fails to describe depositing a first intermediate layer on the second electrode by means of the first and third sputtering targets, wherein the

first sputtering target consisting of the compound $A_{x2'}T_{y2}[PO_4]_{z2}B'_{w2}$ and the chemical element E' and wherein the third sputtering target consisting of the compound $A_{x1}T_{y1}[PO_4]_{z1}B_{w1}$, as recited in claim 42 (from which claims 43 and 44 depend).

The varying concentration of the metal constituent of the metal-silicide layer of Lin would not have provided one of ordinary skill in the art with any reason or rationale to have attempted the method of claims 43 and 44, because, while Lin describes co-sputtering, Lin fails to describe multiple layers of very specific sputtering target compounds, as recited in claims 43 and 44.

Therefore, for at least the reasons discussed above, Bates, Barker and Lin fail to render obvious claims 43 and 44. Withdrawal of the rejection is respectfully requested.

III. New Claim 48

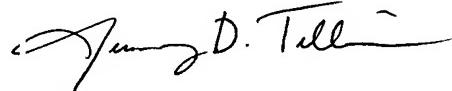
None of the cited references (Bates, Barker, Hashimoto, Shibano or Lin) alone, or in combination, would have rendered obvious a microbattery comprising: a first electrode formed by a thin layer consisting of the active compound LiFePO₄, in which is inserted platinum, a second electrode formed by a thin layer consisting of the active compound LiCoPO₄, in which is inserted platinum, and a solid electrolyte formed by a thin layer consisting of Li₃PO₄, the solid electrolyte being disposed between the first electrode and the second electrode, as recited in new claim 48.

IV. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 24, 27, 32-33 and 40-48 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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